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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/579,211	05/12/2006	Toshihiko Shirasagi	SON-3162	6592

23353 7590 08/03/2010

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ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
08/03/2010	PAPER

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/579,211
Filing Date: May 12, 2006
Appellant(s): SHIRASAGI ET AL.

Christopher Tobin
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 06/02/2010 appealing from the Office action mailed 11/4/2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application: 1, 4-7, and 10.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

4,786,538	Saito	11-1998
4,916,048	Yamada et al.	04-1990
JP-2003-315998	Kouchiyama et al.	11-2003
JP-2001-344826	Lee	12-2001

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 4-7 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouchiyama et al. JP-2003-315988 in view of Saito et al. US 4,786,538, Yamada et al. 4,916,048, and Lee et al. JP-2001-344826(English translation provided) .

Kouchiyama et al. ‘988 teaches a method of micro-fabrication wherein a resist layer including an incomplete oxide of W or Mo is patterned to prescribed shapes by selectively exposing and developing the layer. The incomplete oxide of a transition metal refers to a compound deviated to a direction where the oxygen content is lower than that of a stoichiometric composition (abstract). The resist of the incomplete inorganic oxide is formed by sputtering a target of a transition metal in an atmosphere containing argon and oxygen. The degree of oxidation of the incomplete oxide is controlled by changing the oxygen content in the atmosphere. Varying the oxygen content, the addition of a second transition metal, and the provision of an interlayer are disclosed as methods for increasing the sensitivity of the resist (0059-0063).

Kouchiyama et al. '988 does not teach varying the oxygen concentration so that the concentration near the surface of the substrate is lower than the concentration at the surface of the resist. Further, the reference does not teach the formation of concavo/convex structures of different depths.

Saito et al. teaches varying the oxygen content in the thickness direction of a photosensitive TeO_x film. Thereby the medium obtained may be extremely stable and has excellent adhesive properties between the substrate (abstract). A tellurium or tellurium sub-oxide layer and/or a tellurium dioxide layer are laminated or a tellurium dioxide layer and/or a tellurium or tellurium sub-oxide layer are laminated (2/28-41). See description of figure 1 and figure 2(2/60-65).

In example 4 a film is formed wherein a film of $TeO_{0.1}$ is formed near the surface of the substrate and the oxygen content is increased toward the surface of the photosensitive layer. The surface of the photosensitive layer has a composition of TeO_2 (8/5-31).

Yamada et al. teaches photosensitive sub-oxide materials including WO_x, MoO_x, and TeO_x(abstract).

The teachings of Yamada et al. are used to show that the teaching to vary the oxygen content in a TeO_x film will likely produce the same results in WO_x and MoO_x films. Yamada et al. teaches that these films are interchangeable.

Lee et al. teaches a disc manufacturing method in which grooves and pits having different depths are formed by changing the power of the laser beam(abstract). See figures 2A-B.

It would have been obvious to modify the manufacturing method of Kouchiyama et al. '988 by varying the oxygen content in the inorganic photosensitive layer so that the concentration of oxygen at the surface of the resist layer is higher than that at the surface of the substrate or in which the oxygen content is higher at the surface of the substrate and lower at the surface of the resist based on the example of Saito et al. and based on the teaching of equivalence between TeO_x and MoO_x or WO_x by Yamada et al. and with the reasonable expectation of forming an extremely stable master having excellent adhesive properties between the substrate. Further, it would have been

obvious to one of ordinary skill in the art to form concavo/convex structures having different depths by changing the laser power based on the disclosure of Lee et al.

(10) Response to Argument

i. The Examiner erred in rejecting claims 1,4-7 and 10 under 35 U.S.C. § 103 as allegedly being unpatentable over Japanese Application Publication No. 2003-315998(Kouchiyama) in view of U.S. Patent No. 4,786,538(Saito), U.S. Patent No. 4,916,048(Yamada) and Japanese Application Publication No. 2001-344826(Lee).

A. Japanese Application Publication No. 2003-315988(Kouchiyama)

Appellant states that the examiner readily admits that Kouchiyama et al. does not show varying the oxygen concentration so that the concentration near the surface of the substrate is lower than the concentration at the surface Of the resist. This is correct. However, this feature of the claim is taught by the secondary references, particularly Saito.

B. U.S. Patent No. 4,786,438(Saito)

1. Appellant argues that tellurium is not a transition metal and that the office action fails to show Te being a transition metal. This is correct, Te is not a transition metal. However, the TeOx film is a sub-oxide film that is being used as a recording material by Saito. Transition metal sub-oxide films used as recording materials are taught in the primary Kouchiyama reference.

Appellant also points to disclosure in Saito at column 4, lines 7-9, which discloses addition of Sb, Mo, Ge, Se, Bi, In, Sn etc. to the TeOx film in order to increase laser absorptivity. Thus one would readily envision a $MoTeO_x$ film based on this

disclosure. The examiner points out that the appellant's dependent claim 4 allows for "…a single element or alloy of the transition metal…" to be used as the target material. A target material for forming the $MoTeO_x$ film envisioned above would arguably contain MoTe. Target sputtering in an O_2/Ar atmosphere as taught in Kouchiyama et al. at 0045 or 0084 can be used. Alternatively, a plasma method as described at column 8 lines 45 through 63 of Saito can be used.

Appellant argues that Saito fails to disclose or suggest the oxygen concentration of an inorganic resist layer being increased toward the surface of the substrate from the surface of the inorganic resist layer. This is incorrect. Though Saito may not disclose an inorganic resist layer made of an incomplete oxide of a transition metal where the oxygen concentration of an inorganic resist layer being increased toward the surface of the substrate from the surface of the inorganic resist layer, the reference does disclose an inorganic resist comprising a sub-oxide metal film where this is done.

2. Appellant argues that Saito fails to disclose, teach, or suggest the formation of concave/convex shapes within the TeO_x film. In response, the examiner first notes that formation of concave/convex shapes by exposing and developing an inorganic resist film made of an incomplete oxide of a transition metal, particularly Mo and W, is disclosed in the primary Kouchiyama et al. reference. Saito does fail to disclose, forming resist patterns by exposing, and developing an inorganic resist layer. However, optical sensitivity of the TeO_x films(change in optical characteristics in response to incident light intensity) and their use in optical recording media is disclosed in Saito at column 1 lines 35 through 41. Thus, Saito does disclose exposure of these films to light

but does not disclose a development process to form concave/convex patterns in the material by taking advantage of the change in optical characteristics that occurred in the exposed areas.

C. U.S. Patent No. 4,916,048(Yamada)

1. Appellant argues that Yamada et al. fails to disclose, teach, or suggest an incomplete oxide of a transition metal. This broad statement is incorrect. Yamada et al. at least discloses an incomplete oxide of a transition metal at column 5 lines 21 through 24.

Appellant argues that the office action seems to conclude that the oxygen content in an oxide of tellurium and an oxide of either tungsten or molybdenum would likely produce the same results. The applicant goes on to say that this contention seems to be conclusory at best since the office action fails to show that tellurium and a transition metal are one.

In response the examiner will address these arguments by referring to the teachings of Kouchiyama, Yamada and Saito.

Kouchiyama et al. discloses patterning an inorganic resist film made of an incomplete oxide of a transition metal. Particularly MoO_x and WO_x as cited in the abstract. Particularly of interest in responding to appellant's argument, the examiner notes that Kouchiyama discloses the incomplete oxide may contain one, two, or three transition metals or another element except transition metals and that the incomplete oxide preferably contains plural kinds of metal elements(0039). Available elements

except transition metals include Al, C, B, Si and Ge and at least one of these elements can be used(0041).

Kouchiyama et al. does not disclose varying the oxygen content in the film so that the oxygen concentration is increased toward the surface of said substrate. This feature is taught by Saito. Saito relates to an optically sensitive sub-oxide film. Though Te is not a transition metal, TeO_x is still an optically sensitive sub-oxide film like those taught by Kouchiyama. Further, a $MoTeO_x$ film would be immediately envisioned based on the disclosure in Saito at column 4, lines 7-9 as argued above. Benefits of adjusting the oxygen concentration in the film which include increased adhesive properties between substrates and layers, increased sensitivity, and increased stability are disclosed in Saito (see abstract). Example 5 discloses a film where the oxygen concentration is increased toward the substrate surface from the surface of the photoresist.

It would have been obvious to one of ordinary skill in the art at the time of the invention to form a film having increased oxygen concentration toward the surface of the substrate as disclosed by claim 1 based on the instruction to do so in similar optically sensitive sub-oxide films as taught by Saito and with the reasonable expectation of obtaining the benefits taught by Saito including increased stability, high sensitivity, and increased excellent adhesive properties.

Alone the combination of Kouchiyama and Saito disclose the claimed invention and provide motivation for modifying the oxygen content in an optically sensitive sub-oxide film.

Yamada et al. discloses a "photosensitive film comprising a first element chosen from a group of metals or semimetals and a second element which is different from the first chosen from the group of Te...Mo...W, and an oxygen element… where at least part of the second element exists in a non-oxide state." See Yamada at column 4 line 57-column 5 line 5. Like the films taught by Kouchiyama, which allow for formation of films made up of incomplete oxides of a transition metal with other metal elements, Yamada et al. discloses a sub-oxide film having a metal or semi-metal and a second metal chosen from a group which includes Te, Mo, and W. This shows the equivalence of Te, Mo, and W and provides further motivation for combining the disclosure of Saito, which teaches Tellurium sub-oxide films, with the primary reference Kouchiyama which discloses Tungsten and Molybdenum sub-oxide films.

2. Appellant argues that Yamada fails to disclose forming concave/convex shapes by exposing and developing an inorganic resist layer. In response, the examiner first notes that formation of concave/convex shapes by exposing and developing an inorganic resist film made of an incomplete oxide of a transition metal, particularly Mo and W, is disclosed in the primary Kouchiyama et al. reference. Yamada does fail to disclose, forming resist patterns by exposing, and developing an inorganic resist layer. However, photosensitivity and their use in optical recording media is disclosed in Yamada et al. at column 2 lines 18-19 and column 3 lines 3-30. Thus, Yamada does disclose exposure of these films to light but does not disclose a development process to form concave/convex patterns in the material by taking advantage of the change in optical state that occurs upon exposure.

D. Japanese Application Publication No. 2001-344826(Lee)

1. Appellant argues that Lee fails to disclose teach or suggest an incomplete oxide of a transition metal. This is correct. However, Lee et al is used for its teachings of using different laser powers to form pits having different depths in a manufacturing method for forming an optical disc. Lee et al. is used solely to meet the limitations of claims 6 and 10. It is the position of the examiner that Lee et al. shows both that it is known in the art to form concave/convex shapes having different depths when manufacturing an optical disc master and that a known method for doing this is by changing the laser power used to expose the photosensitive material.

Appellant states that Lee does not teach or suggest the oxygen concentration of an inorganic resist being increased toward the surface of the substrate from the surface of the inorganic resist layer. This is correct. This is taught by the combination of Kouchiyama, Saito, and Yamada.

2. Appellant argues that Lee fails to disclose, teach, or suggest, forming concave/convex shapes. This is incorrect. Lee forms pits and grooves in a manufacturing method for forming an optical disc. See shape of pits and grooves in figures 3, for example, of Lee et al.

Appellant argues that Lee fails to disclose, teach, or suggest forming resist patterns including concave/convex shapes by exposing and developing an inorganic resist layer. This is partially incorrect. Lee does disclose patterns being formed in a photoresist layer. Lee et al. does not disclose whether the resist is an organic or an inorganic resist.

E. Combination of Kouchiyama, Saito, Yamada, and Lee.

1. Standard of Review

2. The combination of Kouchiyama, Saito, Yamada, and Lee fails to meet the standard of obviousness.

Appellant states that the examiner readily admits that Kouchiyama does not disclose varying the oxygen concentration so that the concentration near the surface of the substrate is lower than the concentration at the surface of the resist. This is correct. However, claim 1 actually recites that the "oxygen is increased toward the surface of said substrate from the surface of said inorganic resist layer" and not that the concentration near the surface of the substrate is lower than the concentration at the surface of the resist. This feature of claim one is taught by Saito and Yamada.

The appellant argues that the office action fails to identify some reason that one would modify the oxide of Kouchiyama with the disclosure of Saito. This is incorrect. The office looks to the teachings of Yamada showing equivalence between TeO_x and MoO_x and WO_x films and also points to the fact that both Saito and Kouchiyama et al. pertain to photosensitive sub-oxide films. Though, as argued by appellant, tellurium is something other than a transition metal the disclosure of Yamada, and even the section cited by appellant on page 14 of the brief, discloses equivalence among sub-oxide films of Te, W and Mo. Particularly in the section cited, beginning at column 4 line 57, recites that "a photosensitive layer comprises a first element …wherein at least part of the oxygen element is bonded with the first element to form its oxide and the ratio x of the total number of atoms of the oxygen element to that of the first element, assuming

the maximum valence of the first element in a stable(stoichiometric) oxide to be n, satisfies the relation of o<x<n/2 and where the first element may include Te...Mo.. and W." This passage describes a photosensitive film containing a sub-oxide of Te, Mo, or W. This passage shows equivalence between photosensitive films comprising a sub-oxide of any of these three elements as it describes these as alternatives.

Appellant states that apparently the photosensitive layer of Yamada comprises a first and a second element. This is true. However, appellant's claims are not limited to a film comprising a single element where the single element is a transition metal. See for example claim 4 where a target material can be a single element or alloy of the transition metal.

Appellant argues that no comparison between a TeO_x film and either a MoO_x film or a WO_x film is found in Yamada. Though no comparison of the films is found, equivalence/interchangeability of the films is disclosed in the reference and in particular is disclosed in the paragraph cited by the appellant on page 14 of the brief where photosensitive film comprising a sub-oxide/unstable oxide/ incomplete oxide of a first element that may be either Te, Mo, or W is taught. The valence of a stable oxide is stated to be n while the valence of the oxide of the first element is stated to be greater than zero and less than n/2.

On page 15 of the appeal brief the appellant argues that Saito and Yamada fail to disclose, teach, or suggest, the formation of concave/convex shapes and that the examiner accounts for this deficiency by citing Lee. This is incorrect. Formation of convex/concave shapes is taught by the primary reference Kouchiyama. Saito is used

to provide motivation to change the oxygen content in photosensitive sub-oxide films in order to achieve the benefits of increased sensitivity, stability, and adhesion to the substrate and Yamada is further cited to show equivalence between sub-oxide films of Te , W and Mo. Further, as stated above, though the films of Yamada and Saito are not developed to form a pattern both disclose the films as undergoing changes in optical characteristics as a result of exposure to light.

On page 15 of the appeal brief appellant recites the teachings of Lee and states that Lee fails to disclose the material of the photoresist and thus an artisan would not have referred to Lee for the formation of concave/convex shapes within the films of Saito or Yamada. In response, the examiner again states that formation of concave/convex shapes in films like those taught by Yamada and Saito is already taught in the Kouchiyama reference where concave/convex shapes are formed in at least WO_x and MoO_x films.

B. Claims 4 and 5 stand of fall together:

Examiner has no comment here because appellant has simply recited the limitations recited in claims 4 and 5.

1. Arguments incorporated by reference

2. Japanese Application Publication No. 2003-315998

Appellant argues that Kouchiyama et al. fails to disclose that within a sputtering method, the oxygen concentration of the inorganic resist layer is made different within the thickness direction by changing at least either a film forming power of a reactive gas ratio. It is correct that, as already admitted, Kouchiyama et al. does not

disclose varying the oxygen content in the inorganic resist layer. However, as pointed out in the rejection, Kouchiyama does disclose that the degree of oxidation of the incomplete oxide can be controlled by changing the oxygen content in the atmosphere. See paragraphs (0059-0063). Despite the fact that the inorganic resist formed has a constant degree of oxidation, based on this disclosure one of ordinary skill in the art would recognize that formation of a film having varying degree of oxidations could be done by controlling the oxygen content in the atmosphere while employing a sputtering method.

3. U.S. Patent No. 4,786,538(Saito)

Appellant argues that Saito discloses an ion plating method and thus fails to disclose, teach, Or suggest the process parameters of the ion plating method being compatible with a sputtering process. It is true that Saito discloses an ion plating method. However, use of a sputtering method for forming a sub-oxide film using a metal/metal alloy target and an Ar/O_2 atmosphere where the degree of oxidation of the film can be controlled by varying the amount of oxygen gas(reactive gas) in the atmosphere is disclosed by Kouchiyama. Saito is used for its disclosure of photosensitive sub-oxide films where the oxygen content is varied to produce favorable results. It is clear from the teachings of Kouchiyama et al. that the variation of oxygen content in the film can be achieved by varying the amount of oxygen(reactive) gas is present in the atmosphere during the sputtering process.

Appellant argues that the office action fails to show that the skilled artisan would have substituted the method of Kouchiyama with the ion plating method of Saito. This

is true. Instead the office action would use the method disclosed by Kouchiyama to form a film having varying oxygen content like that taught in Saito because Kouchiyama describes that different oxidation can be achieved simply by varying the amount oxygen/reactive gas present in the atmosphere during the sputtering process.

Appellant again argues that Kouchiyama fails to disclose a sputtering method where the oxygen concentration of the organic resist is made different by changing at least either the film forming power or the reactive gas ratio. This is incorrect and reasoning is given in the section of the response "2. Japanese Application Publication No. 2003-315998". Appellant further argues that the office action fails to show that the variables within the ion plating method of Saito would have been equally applicable to the method of Kouchiyama. This is unnecessary because the method of Kouchiyama can be used to form the photosensitive sub-oxide films having varying oxygen content that are taught by Saito. Kouchiyama discloses a method for forming a sub-oxide film having a constant oxygen content but discloses a method for controlling the amount of oxygen in the film by changing the amount of oxygen/reactive gas in the atmosphere during sputtering.

4. U.S. Patent No. 4,916,048(Yamada)

Here appellant admits that Yamada discloses use of a sputtering method. This sputtering method is used to form films substantially similar to those taught by both Kouchiyama and Saito.

Appellant argues that Yamada fails to disclose that within the sputtering method the oxygen concentration of the inorganic resist layer is made different in the thickness

direction by changing at least either a film forming power or a reactive gas. In response the examiner states at this is disclosed by Kouchiyama and Saito as explained above. Saito shows a photosensitive sub-oxide film that has varying oxygen concentration and Kouchiyama discloses formation of photosensitive sub-oxide films using a sputtering method and further discloses a method for controlling the oxidation of the film by controlling the amount of oxygen/reactive gas present in the atmosphere during the sputtering process.

5. Japanese Application Publication No. 2001-344826(Lee)

Appellant argues that Lee is silent as to the presence of a sputtering method. In response the examiner states that this feature, a sputtering method, is disclosed by Kouchiyama. Further, examiner again states that Lee is used solely to meet the limitations of claims 6 and 10.

Appellant argues that Lee fails to disclose that within the sputtering method the oxygen concentration of the inorganic resist layer is made different in the thickness direction by changing at least either a film forming power or a reactive gas. This is correct. This feature is taught by Kouchiyama and Saito as explained above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Anna L Verderame/

Examiner, Art Unit 1795

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